

CLAIMS

What is claimed is:

1. A multiple-pass fluid rotary union, comprising:

a concentric first member including a plurality of spaced longitudinally directed bores of different lengths extending from at least one end of the first member, wherein each of the longitudinally directed bores terminates at an associated radially directed bore communicating the longitudinally directed bores with an outer surface of the first member; and

a second member including:

a first housing at a first end of the second member, wherein the first housing is rotatably interconnected with the first member;

a second housing approximate a second end of the second member, wherein the second housing is rotatably interconnected with the first member;

a plurality of longitudinally adjacent segments positioned between the first housing and the second housing, wherein each of the segments has an outer surface, an annular inner surface and at least one circumferential groove formed into the inner surface for providing fluid communication with one of the associated radially directed bores of the first member, and wherein each of the segments includes a radially directed bore extending from each of the grooves to the outer surface of the segment; and

a plurality of couplers, wherein one of the couplers is positioned between adjacent ones of the segments, between the segment adjacent the first housing and the first housing and between the segment adjacent the second housing and the second housing, and wherein the first member is positioned within the second member and is rotatable relative thereto.

2. The union of claim 1, wherein the outer surface of each of the segments is annular.
3. The union of claim 1, wherein a seal is positioned between the annular inner surface of each segment and the outer surface of the first member.

4. The union of claim 3, wherein the seal includes a circumferential seal element in the annular inner surface of each of the segments on each side of the grooves thereof in sealing engagement with the outer surface of the first member.
5. The union of claim 1, wherein radially directed passages are located between the grooves providing for at least one of rotary seal leakage detection, collection and drainage.
6. The union of claim 1, wherein the outer surface of the first member includes a wear resistant coating.
7. The union of claim 1, further including:
a secondary seal positioned between each of the annular segments and the first member.
8. The union of claim 1, wherein the coupler between the adjacent segments is a torque coupling/misalignment device.
9. The union of claim 8, wherein the coupler between one of the segments and the first housing is another torque coupling/misalignment device.
10. The union of claim 9, wherein a wear resistant surface treatment is applied to the torque coupling/misalignment devices.
11. A multiple-pass fluid rotary union, comprising:
a concentric first member including a plurality of spaced longitudinally directed bores of different lengths extending from at least one end of the first member, wherein each of the longitudinally directed bores terminates at an associated radially directed bore communicating the longitudinally directed bores with an outer surface of the first member; and
a second member including:
a first housing at a first end of the second member, wherein the first housing is rotatably interconnected with the first member;

an end plate approximate a second end of the second member;

a plurality of longitudinally adjacent segments positioned between the first housing and the end plate, wherein each of the segments has an outer surface, an annular inner surface, at least one circumferential groove formed into the inner surface for providing fluid communication with one of the associated radially directed bores of the first member, and wherein each of the segments includes a radially directed bore extending from each of the grooves to the outer surface of the segment; and

a plurality of couplers, wherein one of the couplers is positioned between adjacent ones of the segments and between the segment adjacent the first housing and the first housing, and wherein the first member is positioned within the second member and is rotatable relative thereto.

12. The union of claim 11, wherein the end plate restricts movement of the segments in the longitudinal direction.

13. The union of claim 11, wherein a seal is positioned between the annular inner surface of each of the segments and the outer surface of the first member.

14. The union of claim 13, wherein the seal includes a circumferential seal element in the annular inner surface of each of the segments on each side of the grooves thereof in sealing engagement with the outer surface of the first member.

15. The union of claim 11, wherein radially directed passages are located between the grooves providing for at least one of rotary seal leakage detection, collection and drainage.

16. The union of claim 11, wherein the outer surface of the first member includes a wear resistant coating.

17. The union of claim 11, further including:

a secondary seal positioned between each of the annular segments and the first member.

18. The union of claim 11, wherein the coupler between the adjacent segments is a torque coupling/misalignment device.
19. The union of claim 18, wherein the coupler between the segment adjacent the first housing and the first housing is another torque coupling/misalignment device.
20. The union of claim 19, wherein a wear resistant surface treatment is applied to the torque coupling/misalignment devices.
21. A multiple-pass fluid rotary union, comprising:
a concentric first member including a plurality of spaced longitudinally directed bores of different lengths extending from at least one end of the first member, wherein each of the longitudinally directed bores terminates at an associated radially directed bore communicating the longitudinally directed bores with an outer surface of the first member; and
a second member including:
a first housing at a first end of the second member, wherein the first housing is rotatably interconnected with the first member;
one of an end plate and a second housing approximate a second end of the second member, wherein the second housing, when present, is rotatably interconnected with the first member;
a plurality of longitudinally adjacent segments positioned between one of the first housing and the end plate and the first and second housings, wherein each of the segments has an outer surface, an annular inner surface, at least one circumferential groove formed into the inner surface for providing fluid communication with one of the associated radially directed bores of the first member, and wherein each of the segments includes a radially directed bore extending from each of the grooves to the outer surface of the segment; and
a plurality of couplers, wherein one of the couplers is positioned between adjacent ones of the segments, between the segment adjacent the first housing and the first housing and between the segment adjacent the second housing and the second housing, when

present, and wherein the first member is positioned within the second member and is rotatable relative thereto.

22. The union of claim 21, wherein the end plate restricts movement of the segments in the longitudinal direction.

23. The union of claim 21, wherein a seal is positioned between the annular inner surface of each of the segments and the outer surface of the first member.

24. The union of claim 23, wherein the seal includes a circumferential seal element in the annular inner surface of each of the segments on each side of the grooves thereof in sealing engagement with the outer surface of the first member.

25. The union of claim 21, wherein radially directed passages are located between the grooves providing for at least one of rotary seal leakage detection, collection and drainage.

26. The union of claim 21, wherein the outer surface of the first member includes a wear resistant coating.

27. The union of claim 21, further including:
a secondary seal positioned between each of the annular segments and the first member.

28. The union of claim 21, wherein the coupler between the adjacent segments is a torque coupling/misalignment device.

29. The union of claim 28, wherein the coupler between the segment adjacent the first housing and the first housing is another torque coupling/misalignment device.

30. The union of claim 29, wherein a wear resistant surface treatment is applied to the torque coupling/misalignment devices.